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Available on loan from the CIA Library are photostatic copies of abstracts of the following papers on low temperature research in the USSR:

(1) Theory of Superfluidity and Critical Velocity in Helium II, by V. L. Ginsburg
Doklady Akad. Nauk, 69, 161, 1941.

(2) Theory of Liquid He^3 (Precis only), by I. Pomeranchuk.
(J. Exp. Theor. Phys, USSR, 20, 919, 1950)
Excitations in He^3.

(3) Some Properties of Solutions of He^3 in He^4, by B. N. Eselson and B. G. Lazarev.
Doklady (Academy of Sciences USSR) 72, 265-267 (1950).

(4) Measurement of Vapour Pressure of Solutions of He^3 in He^4, by B. N. Eselson, B. G. Lazarev, and N. E. Alekseevski.
(J. Exp. Theor. Phys, USSR, 20, 1055, 1950.)

(5) Effective Mass of He^3 and the Speed of Second Sound in Solutions of He^3 in He^4, by I. M. Khalatnikov.
(Communicated by academician L. D. Landau on 25.4.51.)
Doklady Acad. Nauk USSR, 79, 57 (1951).

(6) Study of the Properties of Second Sound, by V. P. Peshkov.
(Journal of Experimental and Theoretical Physics, USSR, Volume 18, No. 10, October 1948, p. 867).

(7) Dispersion of Second Sound at Low Temperatures, by V. P. Peshkov.
(J. E. T. P., USSR, 19, 270, 1949).

(8) On the Temperature-Dependence of the Thickness of the He II film, by M. I. Kaganov and B. N. Eselson.
(Letter in J. Exp. Theor. Phys., USSR, 21, 656, 1951) 7

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1. Much of the present theory of low temperature physics is based on the work of L. Landau of the Soviet Academy of Sciences, USSR. The theory of Landau makes it possible to theoretically estimate many of the physical properties of matter at temperatures in the neighborhood of absolute zero. Certain adjustable parameters of his theory are left to be determined by actual experimentation. Two of his basic papers are required reading for any understanding of current work in the field. They are:

   (a) The Theory of Superfluidity of Helium II, by L. Landau, 1941, published in the Journal of Physics, Vol. 5, No. 1.

   (b) A supplementary paper correcting certain parameters of his early theory entitled "On the Theory of Superfluidity of Helium II" received Nov. 15, 1946 in letters to the editor of the Journal of Physics.

   Another basic work is entitled "Heat Transfer and Superfluidity of Helium II" by P. Kapitza, 16 May, 1941. It is evident from the bibliographies listed with the above papers that Soviet scientists do have access to work done in the West.

2. A competing theory is that of Laszlo Tisza who worked in the US in conjunction with Fritz London. One of the principal differences in the two theories is that Tisza's theory predicts the velocity of second sound to approach zero as the temperature approaches absolute zero. Landau predicts a velocity of second sound approaching the value of $U_1/\sqrt{3}$ where U_1 is the velocity of first sound. Experimental work in the US at temperatures near zero Kelvin give a qualitative confirmation of Landau's theory of phonons and rotons. Experiments on liquid helium attempting to confirm Tisza's theory show perhaps somewhat better correlation than for Landau's theory above 1° Kelvin but the science is so new that there are still many anomalies. Significant temperatures for comparisons between the two theories are:

   (a) The boiling point of liquid helium, ± 2° Kelvin

   (b) The Lambda (λ) point of liquid helium, 2° Kelvin -- below which helium exhibits superfluidity and other peculiar second order effects.

   (c) 1° Kelvin -- the temperature below which Landau's theory gives qualitative agreement for liquid helium experiments, and Tisza's theory applies less well.

   At present no λ point for He^3 has been experimentally determined, and until a λ point can be proved to exist for He^3, Tisza's theory may not be generally applicable.

3. The reports listed above are characteristic of the Soviet work in low temperature. They are predominantly theoretical papers which attempt to explain the phenomena of low temperature physics. As far as I can see they reflect interest in pure science only. Paper numbered (1) by V. L. Ginsburg is included because it shows that the author is free to make objective constructive criticism of the basic theory laid down by the leader of Soviet low temperature physics, L. Landau. It is probable that the minor corrections recommended by Ginsburg are correct.

4. It also appears that students of Landau are permitted to progress and publish work on their own. For instance, I. M. Khalatnikov wrote most of his early papers under Landau and devoted much time to confirming and expanding Landau's theory. His principal contributions have been in the field of the absorption of sound in Helium II. Khalatnikov's equations for first sound in Helium II have been qualitatively confirmed in the US. However, the parameters which he gives for a computation of second sound in Helium II have not been confirmed and do not seem to coincide with his own theoretical curves. In 1951 Khalatnikov appears as the author of a paper on Second Sound in Solutions of He^3 in He^4, paper number 5.

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5. The chief advantage that low temperature physicists in the US have is an abundance of helium for use in experimental confirmation of theoretical predictions. In addition we in the US seem to have been able to do more work with He^3 than the rest of the world. He^3 can be obtained as a side product from a nuclear reactor but it can also be obtained by separating it from solutions of He^4. While papers 2 to 5 reflect Soviet experimental work in solutions of He^3 in He^4, they give no evidence of anything but theoretical work on He^3. With the exception of second sound studies by Peshkov, papers 6 and 7, I have seen very little record of Soviet experimental work. We know that they have a low temperature laboratory in Moscow and I believe it is significant that there seems to be a disproportionate amount of theoretical work coming out of the USSR. I would assume that this is because the Soviets have, for some reason, decided to classify experimental work. I could not guess whether this implies military applications of their low temperature work or whether they are trying to cover up their supply of helium or research equipment.

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6 [redacted] I remember seeing an experimental paper published in Yugoslavia which gave diagrams of dewars with experimental equipment inside which were in use in the low temperature laboratory in Moscow. We were not particularly impressed with the quality of the work reported. It dealt with the rate of film flow of liquid neon, argon or krypton over solid surfaces. Such papers might give an indication of the degree of availability of helium and low temperature equipment in the USSR, however.

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